

Histological, Morphological and Sonographical Study of age related changes in Human Pancreas

Ahmed H. Hussein¹ , Abdul - Jabbar Jameel² , Samira Abdul Hussain³

¹University of Tikrit / College of Medicine.

¹ahussein2029@gmail.com

^{2,3}University of Tikrit / College of Medicine.

²drjabarjamil@yahoo.com , ³Ahmed.bayoglu@yahoo.com

Received date : 15 / 2 / 2015

Accepted date : 22 / 10 / 2015

ABSTRACT

Ageing stress induce an effect on each body cell causing degeneration and malfunction as consequence this appear in different investigation degree of views so this study was mad to investigate the anatomical, histological and sonographical changes during aging process in pancreas. The pancreas specimens were divided into five groups (four pancreas specimens) according to cadaver age ranging from 21- 70 years, to five groups : group A (21-30 years), group B (31-40 years), group C (41-50 years) ,group D (51-60) and group E (61-70). The pancreas were inspected grossly for their shape and Location. The morphometrics of pancreas in the present study was 20.3 ± 2.3 (cm) as a maximum mean length in group B and 15.6 ± 0.9 (cm) as a minimum mean length in group E. The weight of pancreas in this study a maximum mean weight in group B was 122.41 ± 0.27 (gm) and minimum mean weight in group E was 75.52 ± 0.28 (gm). Microscopically, pancreatic section showed that, the pancreas was covered by a thin fibrocollagenous connective tissue capsule from which septa extend into the gland dividing it into lobules. Nerves and blood vessels extended within the septa, the lobules contain exocrine tissue and endocrine tissue . Diameter of pancreatic acini ranged from 49 ± 10 (μ m) in head region of group B to 14 ± 2 (μ m) in the tail region of group E . The diameter of Islet of Langerhans ranged from 102 ± 2 (μ m) in head region of group B to 48 ± 15 (μ m) in the tail region of group E, thickness of pancreatic septa in the head was 86 ± 3 (μ m) as a maximum value in group E and in the tail was 36 ± 5 (μ m) as a minimum value in group A .

In addition, an ultrasonographic pancreas gland inspection were performed on forty volunteers who were similarly divided according to age into five groups (eight individuals for each), according to age, the ultrasound inspection concerned with length and width of gland .

The results showed that the age have a reliable degeneration effect specially after 40 years old, other further investigation on different population and further tools help to show more details about age related changes.

Keywords: Pancreas, Anatomy, Histology, sonograph.

دراسة نسيجية وشكلية و الموجات فوق الصوتية بالتغيرات المرتبطة بالعمر في

بنكرياس الإنسان

أحمد حسن حسين¹ ، عبد الجبار جميل مهدي² ، سميرة عبد الحسين عبد الله³

¹ جامعة تكريت/ كلية الطب/ فرع التشريح

¹ahusseini2029@gmail.com

^{2,3} جامعة تكريت / كلية الطب العام

²drjabarjamil@yahoo.com , ³Ahmed.bayoglu@yahoo.com

تاريخ قبول البحث: ٢٢ / ١٠ / ٢٠١٥

تاريخ استلام البحث: ١٥ / ٢ / ٢٠١٥

الملخص

الاجهاد الحاصل خلال تقدم العمر له تأثير على كل خلايا الجسم مؤديا الى انتكاسها وبالتالي خلل في عملها والأعضاء ككل، هذا التأثير يظهر كحقيقة يتباين وضوحها باختلاف أدوات البحث المستخدمة، صممت هذه الدراسة لإظهار مدى تأثير تقدم العمر على غدة البنكرياس باستخدام الكشف التشريحي العياني، التقطيع النسيجي و الكشف بالموجات فوق الصوتية. قسمت النماذج إلى خمس مجاميع كل مجموعة تتراوح اعمارها حسب التصنيف التالي: مجموعة (أ) (٢١ - ٣٠ سنة) مجموعة (ب) (٣١ - ٤٠ سنة) ومجموعة (ج) (٤١ - ٥٠ سنة) ومجموعة (د) (٥١ - ٦٠ سنة) و مجموعة (هـ) (٦١ - ٧٠ سنة) وكل مجموعة تحتوي على أربع عينات وتم فحص أشكالها وموقعها التشريحي وامتداداتها وطولها حيث وجد اقصى طول بمجموعة (ب) بمعدل 20.3 ± 2.3 سم) واقله في المجموعة (هـ) بمعدل 15.6 ± 0.9 سم)

فضلا عن قياس وزنها الذي وجد (12241.0 ± 0.27 غم) بالمجموعة (ب) و (70.52 ± 0.28 غم) بالمجموعة (هـ). استخدمت المجهر الضوئي حيث وجدت الغدة مغطاة بكبسولة رقيقة من النسيج الضام الذي تمتد إلى الغدة وتقسيمه إلى فصيصات الأعصاب والأوعية الدموية الممتدة داخل الحاجز، الفصيصات تحتوي على الأنسجة الإفرازية والغدد الصماء. فحصت النماذج لأجل حساب اقطار الجريبات الافرازية التي تراوحت ما بين (49 ± 15 مايكرو) بالمجموعة (ب) الى (18 ± 2 مايكرو) بالمجموعة (هـ) ، و اقطار جزر لانكرهانز تراوحت بين (2102 ± 2 مايكرو) بالمجموعة (ب) و (48 ± 15 مايكرو) بالمجموعة (هـ) وايضا قياس سمك النسيج الضام التي وجدت باقصى سمك (86 ± 3 مايكرو) بالمجموعة (هـ) وياقل سمك (36 ± 5 مايكرو) بالمجموعة (أ) .

فضلا عن ذلك استخدمت تقنية الموجات فوق الصوتية لأجل حساب الطول والعرض للغدة في ٤٠ متطوعا وتم تقسيم المتطوعين استنادا إلى العمر إلى خمسة مجاميع كل مجموعة تحتوي على ثمانية أشخاص. أوضحت النتائج في البحث ان للعمر تأثير سلبي على غدة البنكرياس يتوضح جليا بعد عمر ٤٠ سنة، ان إتمام دراسات أخرى على مجتمعات سكانية مختلفة واستخدام أدوات بحث أكثر كما ونوعا قطعا سيعطي تفاصيل أكثر باتجاهات أخرى مختلفة لتأثير التقدم في العمر لذا ننصح بإجراء هكذا أنواع من الدراسات مستقبلا.

الكلمات الدالة: البنكرياس، علم التشريح، علم الأنسجة، الموجات فوق الصوتية.

1. INTRODUCTION

The name pancreas derives from the Greek roots ‘pan’ meaning ‘all’ and ‘creas’ meaning ‘flesh’[1].The pancreas is a soft, elongated digestive gland which is grey–pink and ‘feather-like’ in appearance. It is approximately 15 cm in length, lobular and weighs about 80 g. It is retroperitoneal and extends transversely across the posterior abdominal wall from the curve of the duodenum to the hilum of the spleen, lies across the vertebral bodies of L1–L3. It is posterior to the stomach and the transverse mesocolon is attached to its anterior margin. It is located in the left hypochondriac and epigastric regions. The pancreas has four parts: a head with an uncinat process (from the Latin meaning ‘hook’), a neck, a body and a tail [Figure 1] [2].The pancreas is an important organ that produces digestive enzymes and hormones to control blood glucose homeostasis, the pancreas is often described as two organs in one, due to the distinct function and organization of its endocrine and exocrine components[3-5].

The endocrine pancreas consists of functional units organized into cell clusters called islets of Langerhans where insulin-producing cells are found in the core and surrounded by glucagon-, somatostatin-, pancreatic polypeptide-, and ghrelin-producing cells [6].

Exocrine pancreas, the portion of the pancreas that makes and secretes digestive enzymes into the duodenum. This includes acinar and duct cells with associated connective tissue, vessels, and nerves [7].

2. Materials and Methods

Twenty normal pancreas of adult male cadavers grouped into five groups A, B, C, D and E, including ten years in each group with ages ranging from 21 - 70 years :-

- Group (A): ranged from 21-30 years.
- Group (B): ranged from 31-40 years.
- Group (C): ranged from 41-50 years.
- Group (D): ranged from 51-60 years.
- Group (E): ranged from 61-70 years.

Cadavers grouped taken from forensic medicine department of Tikrit and Kirkuk Teaching Hospital from both Salahddin and Kirkuk province during the period extended from December 2013 to June 2014, dissecting technique for abdominal approach was by using the procedure described by Patrick [8]. Gross measurements of the pancreas including weight and length were calculated in metric system by using electronic balance and ruler respectively, for histological study two procedures were used for evaluating morphometric criteria a conventional routine procedure using eosin and hematoxlin [9], and special stain procedure using Van Giesons staine [10], general histological view, number and diameter to the acini, Islets of langerhans and septa were described, counted and calculated respectively by using light microscope (Olympus) with micrometer type calibrated ocular lenses (Reichert®), Ultrasonographic examination was according to the name procedure [11], using ultrasonographic system (AlokaSSD500 - Japan) with a 3.5 – MHz curved –array transducer with a wide (11cm) contact surface.

3. Results

In the present study mean \pm SD of total pancreatic gland anatomical weights and length were reach the maximum value in groups B [Table \(1\)](#) .The largest mean \pm SD values of acini

Table (2) and Islet of Langerhans Table (3) for diameter in group A, B, C, D, and E for head, body and tail region of pancreas were in group B and decrease during aging, thickness of pancreatic septa revealed obvious differences correlated to the age, the largest mean±SD thickness values were in group E and the smallest were in group A Table (4) Fig. (2) and (3). ultrasonographic investigation results was nearly similar to anatomical results Table (5) Fig. (4).

Table (1): Weight and Length of pancreas gland in different age groups

| Groups | Age (Year) | Weight (gm) Mean±SD | Length (cm) Mean±SD |
|--------|------------|------------------------|------------------------|
| A | 21-30 | 121.84±1.62 | 19.47±1.3 |
| B | 31-40 | 122.41±0.27 | 20.3±2.3 |
| C | 41-50 | 116.63±4.98 | 19.17±2.4 |
| D | 51-60 | 100.93±2.63 | 18.1±1.4 |
| E | 61-70 | 75.52±0.28 | 15.6±0.9 |

Table (2): Diameter of pancreatic acini in head, body and tail region with different age groups

| Groups | Age (Year) | Diameter of acini in head (µm) Mean±SD | Diameter of acini in body (µm) Mean±SD | Diameter of acini in tail (µm) Mean±SD |
|--------|---------------|--|--|--|
| A | 21-30 | 49±15 | 36±15 | 31±18 |
| B | 31-40 | 57±18 | 53±15 | 38±13 |
| C | 41-50 | 33 ±12 | 30±17 | 23±13 |
| D | 51-60 | 25±13 | 20±13 | 19±8 |
| E | 61-70 | 24±10 | 19±8 | 18±2 |

Table (3): Diameter of pancreatic Islets in head, body and tail region with different age groups

| Groups | Age (Year) | Islets in head (μm) | Islets in body (μm) | Islets in tail (μm) |
|--------|------------|----------------------------------|----------------------------------|----------------------------------|
| | | Mean \pm SD | Mean \pm SD | Mean \pm SD |
| A | 21-30 | 102 \pm 2 | 81 \pm 6 | 73 \pm 13 |
| B | 31-40 | 102 \pm 2 | 107 \pm 3 | 103 \pm 12 |
| C | 41-50 | 88 \pm 1 | 76 \pm 5 | 72 \pm 8 |
| D | 51-60 | 82 \pm 4 | 75 \pm 3 | 65 \pm 5 |
| E | 61-70 | 74 \pm 8 | 73 \pm 2 | 48 \pm 15 |

Table (4): Thickness of pancreatic septa in head, body and tail region with different age groups

| Groups | Age (Year) | septa in head (μm) | septa in body (μm) | septa in tail (μm) |
|--------|------------|---------------------------------|---------------------------------|---------------------------------|
| | | Mean \pm SD | Mean \pm SD | Mean \pm SD |
| A | 21-30 | 49 \pm 7 | 43 \pm 12 | 36 \pm 5 |
| B | 31-40 | 53 \pm 7 | 45 \pm 10 | 40 \pm 5 |
| C | 41-50 | 74 \pm 2 | 60 \pm 10 | 56 \pm 8 |
| D | 51-60 | 78 \pm 5 | 69 \pm 12 | 67 \pm 2 |
| E | 61-70 | 86 \pm 3 | 72 \pm 15 | 68 \pm 10 |

Table (5): Ultrasonic examination the length of pancreas correlated to different age groups

| Groups | Age (Year) | Length (cm) |
|--------|------------|-----------------|
| | | Mean \pm SD |
| A | 21-30 | 16.87 \pm 1.1 |
| B | 31-40 | 17.74 \pm 1.8 |
| C | 41-50 | 16.37 \pm 0.4 |
| D | 51-60 | 15.61 \pm 1.7 |
| E | 61-70 | 13.59 \pm 0.6 |

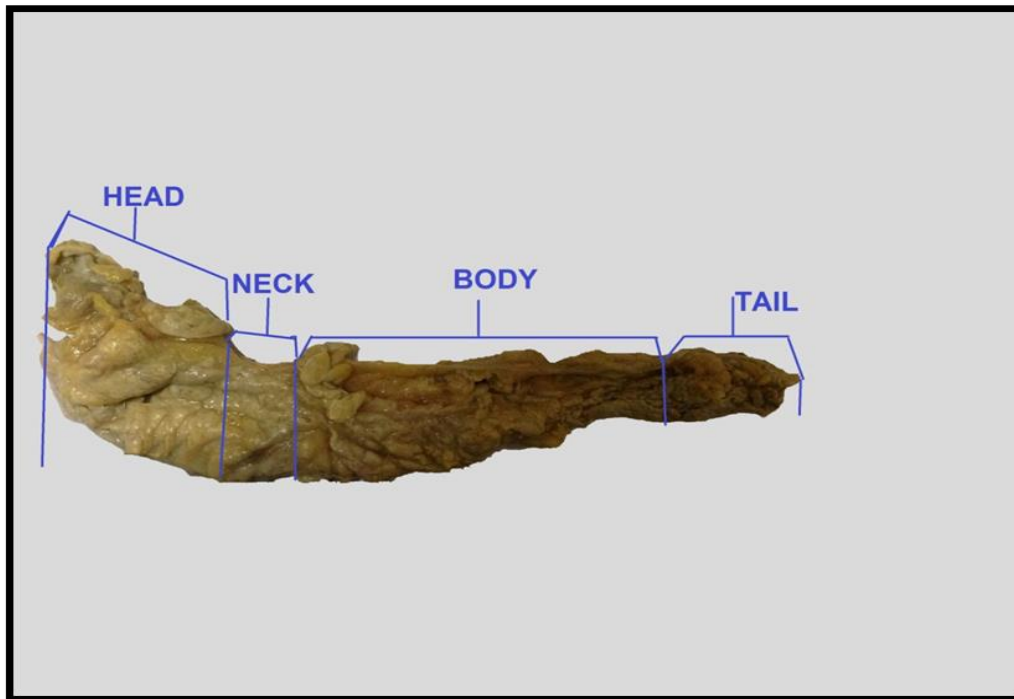


Fig. (1): shows the pancreas and its parts

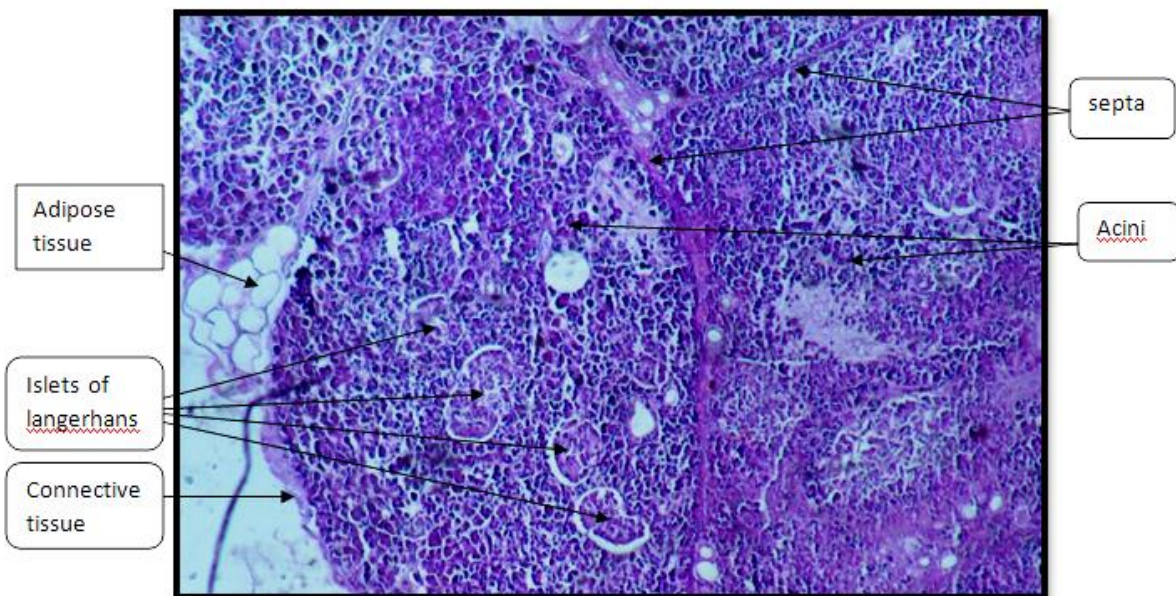


Fig. (2): Shows the Endocrine and Exocrine portion of pancreas

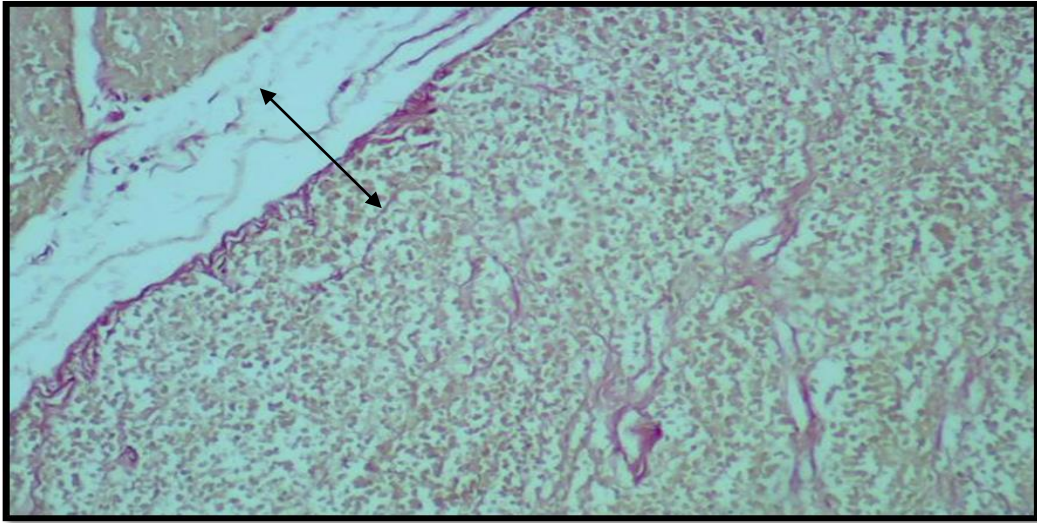


Fig. (3): Thickness of pancreatic septa in group E (Van G .10X)

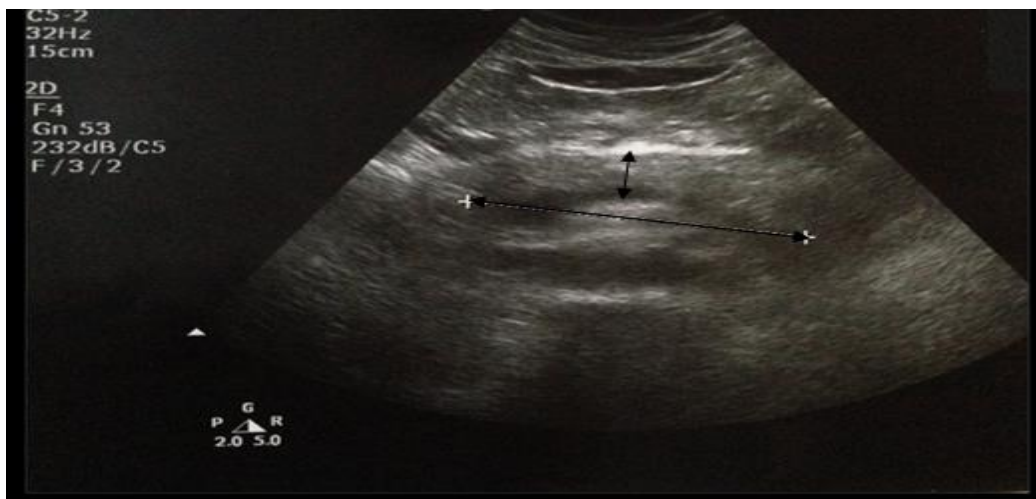


Fig. (4): Ultrasonic examination the length of the pancreas

4. Discussion

The weight of pancreas in this study as a total adult pancreatic weight agreed study done by caglar V. and Kumral B [12], in Turkish populations, in the present study a maximum mean weight in group B was 122.41 ± 0.27 (gm) and minimum mean weight in group E was 75.52 ± 0.28 (gm), in Turkish study the mean weight of pancreas was 87.3 ± 30.6 (gm) for ages ranged from 25-88 years old. The length of pancreas in the present study was 20.3 ± 2.3 (cm) as a maximum mean length in group B and 15.6 ± 0.9 (cm) as a minimum mean length in group E this result agreed with Nayak and Mun yooi [13] who showed that the pancreas length ranged from 15-20 (cm). Sulochanae S and Sivakami T [14] , showed that the mean length of



pancreas was 16.38 ± 2.38 (cm) with ages ranged from 23 to 61 years old. The decline in Islet number and size along with age in fact it is a consequence to deterioration that occur in all tissue and organs with the passage of time due to the progressive accumulation of the malfunctioning cell components because of oxidative damage and an age dependent decline of turnover rate and housekeeping [15].

The size of islet depend on circumstances of islet growth and growing of islets regulated by several factors physical constraints one of them such as the minimal size required for stable cell-to-cell coupling and the upper limit to keep the ratios between cell types [16], functional properties is another factor control islet sizes [17].

Sonographic appearance of pancreas including homogeneity, color and echoes texture with smooth contours support the normality of the pancreas, these findings agree with what is suggested to shown in pancreas free of diseases. The available data suggest that there are effects of age and adiposity on pancreas volume ,anatomical studies report decreased pancreas volume with aging in humans and histological studies report atrophy, fibrosis, and fatty infiltration of the pancreas in the aging population [18].

References

- [1] J. Slack, *Developmental biology of the pancreas*. Development, 1995;121:1569- 80.
- [2] Chew Rusheng ; Horton-Szar Daniel. *Gastrointestinal System* .3rd Ed .,Ch5. Elsevier Health Sciences,2008; 107.
- [3] L. C. Murtaugh Pancreas and beta-cell development: *from the actual to the possible*. Development. 2007; 134(3): 427-38.
- [4] J.M. Oliver-Krasinski and D.A. Stoffers On the origin of the β cell. Genes and Development. 2008; 22 (15): 1998–2021.
- [5] F.C. Pan and C.Wright Pancreas organogenesis: *from bud to plexus to gland*. Developmental Dynamics. 2011; 240(3): 530–65.
- [6] A. Mansouri *Development and Regeneration in the Endocrine Pancreas*. ISRN Endocrinology. 2012 ; 640956:12
- [7] Daniel.Longnecker, *Anatomy and Histology of the Pancreas*. Exocrine Pancreas Knowledge Base, The Pancreapedia, 2014.

- [8] w.Patrick Grant's Dissector . 15th Ed. *lippincott williams & wilkins* . A Wolters Kluwer Company,2013; 112-114..
- [9] G.Avwiuro Histochemical uses of haematoxylin . JPCS , 2011; 1 :24-34.
- [10] Lee G Luna *Manual of histological Staining Methods of the armed forces institute of pathology*. McGraw- Hill Inc ,1968 : 23 ,76.
- [11] A Martinez-Noguera, M.D'Onofrio *Ultrasonography of the pancreas*. Conventional imaging. *Abdom Imaging* , 2007;32(2):136–49.
- [12] V. (129) Caglar, B. Kumral Ramazan Uygur, Ozan Alper Alkoc, Oguz Aslan Ozen and et al. Study of Volume, Weight and Size of Normal Pancreas, Spleen and Kidney in Adults Autopsies. *Forensic Medicine and Anatomy Research*,2014; 2: 63-69.
- [13] b. s. Nayak, & O. A Mun yooi, *classic case of annular pancreas and its clinical implications*. *Int. J. Morphol.*,2011; 29(2):559-61.
- [14]Sulochanae S. and T. A sivakami *gross morphological study of the pancreas in human cadavers* .*National journal in clinical anatomy*, 2012; 1(2): 55-60.
- [15] E .Bergamini, G Cavallini, A Donati and Z Gori . *The role of macroautophagy in the ageing process, anti-ageing intervention and age-associated diseases*. *Int. J. Biochem. Cell Bio*. 2004; 36: 2392-2404.
- [16] Jo. Junghyo, Moo Young Choi, and Duk-Su Kohz.. *Size Distribution of Mouse Langerhans Islets*. *Biophysical Journal* . 2007;93: 2655–66.
- [17] X.Wang and R. Misawa1 *Regional Differences in Islet Distribution in the Human Pancreas - Preferential Beta-Cell Loss in the Head Region in Patients with Type 2 Diabetes* . 2013 ; 8 :67454
- [18] G.L. de la Grandmaison, I. Clairand and M. Durigon *Organ weight in 684 adult autopsies*. New tables for a Caucasoid population.. 2001;119:149-54.

AUTHOR



Ahmed H. Hussein: Bachelor in Veterinary Medicine and Surgery
from University of Tikrit .